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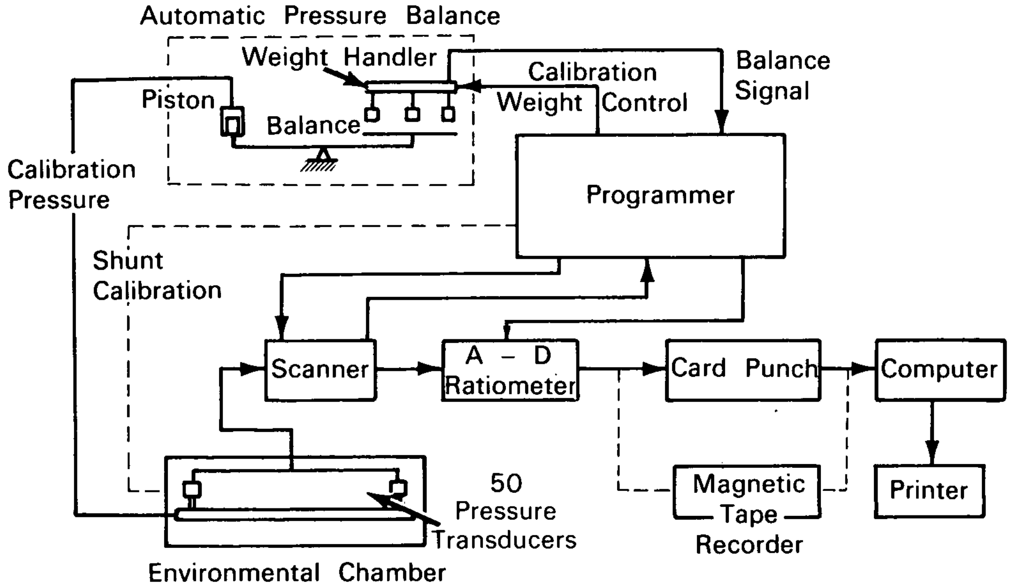
NASA TECH BRIEF

Automatic Calibration System for Pressure Transducers



Calibration of individual pressure transducers at different temperatures, using as a calibration standard the conventional dead weight tester, would require many manhours, large amounts of space, and large duplications of equipment, resulting in great cost per unit calibrated. Calibration output was increased by manifolding a larger number of gages with the same range, but this method required the use of transfer standards, manual pressure regulations, and individual readings. The use of secondary standards is the greatest disadvantage of this method, but manual pressure regulation and the large chance for human errors are also very undesirable. It was evident, that a more basic standard, automatic operation, and manifolding of a large number of gages would be necessary to increase quantity and accuracy for test, evaluation, and calibration of pressure transducers. These problems were solved with the 50-channel automatic pressure transducer calibration system.

The pressure transducers to be calibrated are installed in an environmental test chamber and manifolded to connect them to the pressure balance which

(continued overleaf)

is the calibration pressure source and standard. The test chamber provides a temperature range of −120° to +350°F (188.7° to 449.8°K); it takes up to two hours to reach temperature stability and equilibrium when the temperature setting is changed.

The programmer controls the binary coded signals for all steps of the operation; it has the following four subunits: pressure control matrix, shunt control matrix, system or logic control matrix, and computer.

Four selector switches serve to dial the full-scale pressure desired for the calibration, and additional push-button switches program the computer to perform calibrations in the desired steps and increments. For shunt calibration, the programmer connects the transducer bridges either with the shunt calibration resistors in the programmer box or with the shunt resistors built into the transducers.

The scanner sequentially connects all transducers to the analog-to-digital ratiometer. This ratiometer compares the output signals of the connected transducer with the voltage of a reference power supply and applies the millivolt/volt output-input ratio in digital form to the card punch or magnetic tape recorder. A standby power supply provides normal excitation of the transducers, and when the scanner connects a transducer to the ratiometer, the excitation of the transducer is switched to the reference voltage. The reference power supply is periodically checked when the scanner connects it to a calibration standard which provides precision dc voltage.

The output of the digital ratiometer is recorded on punch cards, together with temperature, barometric pressure, and programming instructions. A coded formula identifies channel numbers and pressure steps or shunt calibration steps. The IBM 526 printing summary punch is used. This multipurpose machine has a programming drum and is suitable for various recording and controlling applications.

The punched cards are sorted and printed out locally for checks and raw data files. Calculations are performed to determine sensitivity, linearity, hysteresis, temperature characteristics, and deviation limits. A summary sheet of these data provides quick-look information about the usefulness of a transducer for a special application. Then shunt calibrations are made with the real data acquisition systems at the test stands or wherever the transducers are used. The combination of pressure and shunt calibrations in the laboratory, and the shunt calibrations in the field satisfy all calibration requirements and provide very reliable calibration data for evaluation of the field measurement.

Note:

No additional documentation is available. Questions may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546

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